APPENDIX E:

APPROVED MATERIALS SPECIFICATIONS

Specifications

FIRE HYDRANT
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FIRE HYDRANTS

PART 1 – GENERAL

Fire hydrants purchased or installed shall meet or exceed all applicable requirements and tests of ANSI and the latest revisions of AWWA Standard C502. Fire hydrants shall meet all test requirements and be listed by Underwriters Laboratories Inc. Fire hydrants shall meet all test requirements and have full approval of Factory Mutual. Hydrants shall be Mueller Super Centurion.

PART 2 – PRODUCTS

Fire hydrants shall meet the following requirements:

1. Fire hydrants shall be rated for a working pressure of 250 Psig.
2. Fire hydrants shall be of the compression type, opening against the pressure and closing with the pressure.
3. Fire hydrants shall have a minimum 5-1/4" main valve opening and a minimum inside lower/upper barrel diameter (I.D.) of 7" to assure maximum flow performance. Pressure loss at 1,000 GPM shall not exceed the following values:
   - 4" Pumper Nozzle: 2.70psi
   - 4.5" Pumper Nozzle: 2.50psi
4. Fire hydrants shall be three-way in design, having one pumper nozzle (size as specified) and two 2-1/2" hose nozzle(s). Nozzle thread type shall be as specified by the end user. Nozzles shall thread counterclockwise into hydrant barrel utilizing "o" ring seals. A suitable nozzle lock shall be in place to prevent inadvertent nozzle removal.
5. The bonnet assembly shall provide an oil reservoir and lubrication system that automatically circulates lubricant to all stem threads and bearing surfaces each time the hydrant is operated. This lubrication system shall be sealed from the waterway and any external contaminants by use of "o" ring seals. An anti-friction washer shall be in place above the thrust collar to further minimize operating torque. The oil reservoir shall be factory filled with a low viscosity, FDA approved non-toxic oil lubricant which will remain fluid through a temperature range of -60^0 F. to $+150^0$ F.
6. The operating nut shall be a one piece design, manufactured of ASTM B-584 bronze. It shall be pentagon/square in shape and the nut dimensions shall be as specified by the end user. The operating nut shall be affixed to the bonnet by means of an ASTM B-584 bronze hold down nut. The hold down nut shall be threaded into the bonnet in such a manner as to prevent accidental disengagement during the opening cycle of the hydrant. The use of Allen head set screws as a means of retention is unacceptable. A resilient weather seal shall be incorporated into the hold down nut, for the purpose of protecting the operating mechanism from the elements.
7. The direction of the opening shall be as specified by the end user. An arrow shall be cast on the bonnet flange to indicate the specified opening direction.
8. The hydrant bonnet shall be attached to the upper barrel by not less than eight bolts and nuts and sealed by an "o" ring.
9. Hydrants shall be a "traffic-model" having upper and lower barrels joined at the ground line by a separate and breakable "swivel" flange providing 360^0 rotation of upper barrel for proper nozzle

facing. This flange shall employ not less than eight bolts. The safety flange segments shall be located under the upper barrel flange to prevent the segments from falling into the lower barrel when the hydrant is struck. The pressure seal between the barrels shall be an "o" ring. The proper ground line shall be cast clearly on the lower barrel and shall provide not less than 18" of clearance from the centerline of the lowest nozzle to the ground.

10. The operating stem shall consist of two pieces, not less than 1 1/4" diameter (excluding threaded or machined areas) and shall be connected by a stainless steel safety coupling. The safety coupling shall have an integral internal stop to prevent the coupling from sliding down into the lower barrel when the hydrant is struck. Screws, pins, bolts, or fasteners used in conjunction with the stem couplings shall also be stainless steel. The top of the lower stem shall be recessed 2" below the face of the safety flange to prevent water hammer in the event of a "drive over" where a vehicle tire might accidentally depress the main valve.

11. The lower barrel shall be an integrally cast unit. The use of threaded on or mechanically attached flanges is deemed unacceptable. The hydrant bury depth shall be clearly marked on the hydrant lower barrel.

12. Composition of the main valve shall be a molded rubber having a durometer hardness of 95 +/- 5 and shall be reversible in design to provide a spare in place. Plastic (polyurethane) main valves are unacceptable. The main valve shall have a cross section not less than 1".

13. Hydrants shall be equipped with (2) two drain valves which drain the barrel when the hydrant is closed and seal shut when the hydrant is opened. These drain valves shall be an integral part of the one piece bronze upper valve plate. They shall operate without the use of springs, toggles, tubes, levers or other intricate synchronizing mechanisms.

14. The upper valve plate, seat ring and drain ring (shoe bushing) must be ASTM B-584 bronze and work in conjunction to form an all bronze drain way. A minimum of two (2) internal and two (2) external drain openings are required. Drains ported through an iron shoe must be bronze lined.

15. The bronze seat ring shall thread into a bronze drain ring (or shoe bushing) providing a bronze to bronze connection. Seat rings shall be "o" ring pressure sealed

16. The shoe inlet size and connection type shall be as specified (flanged, MJ, etc.), having ample blocking pads for sturdy setting and the MJ connection must have two strapping lugs to secure the hydrant to piping. A minimum of six bolts and nuts is required to fasten the shoe to the lower barrel.

17. The interior of the shoe including the lower valve plate and stem cap nut shall have a protective coating that meets the requirements of AWWA C-550. If a stem cap nut is utilized, it must be locked in place by a stainless steel lock washer or similar non-corrosive device that will prevent the cap nut from backing-off during normal use.

19. Hydrants shall be warranted by the manufacturer against defects in materials or workmanship for a period of ten years (10) from the date of manufacture. The manufacturing facility for the hydrant must have current ISO certification.

PART 3 – EXECUTION

Hydrants shall be installed per written manufacturer's instructions. See District detail. The District reserves the right to accept only those materials which are in full compliance with this specification and deemed most advantageous to its interests.

GATE VALVES

PART 1 – GENERAL

This specification covers all valves, valve operators, valve boxes, fittings, and thrust blocking required for this job. Gate valves shall be manufactured by Mueller.

PART 2– MATERIALS

Gate Valves: Gate valves shall meet the following requirements:

1. The resilient seat gate valves shall fully comply with the latest revision of AWWA C509, and shall also be UL listed and FM approved. The valves shall be tested and certified to ANSI/NSF 61.
2. The valve shall have a 250 psig working pressure.
3. The valve type shall be NRS (non-rising stem) or OS&Y (outside screw & yoke) as specified.
4. The valve shall have an arrow cast on the operating nut or handwheel showing opening direction. The direction of opening shall be as specified.
5. The NRS valves shall be provided with a 2" square operating nut and OS&Y valves shall be provided with a handwheel. The bolt that attaches the operating nut to the stem shall be recessed into the operating nut so as not to interfere with valve wrench operation.
6. The valves shall have bolts and nuts for the stuffing box and bonnet with one of the following compositions: Type 304 stainless steel or Type 316 stainless steel.
7. The valve stem shall be made of bronze ASTM B-132 alloy C67600 bar stock material. The stem shall have at least one "anti-friction" thrust washer above and below the stem collar to reduce operating torque. The design of the NRS valve stem shall be such that if excessive input torque is applied, stem failure shall occur above the stuffing box at such a point as to enable the operation of the valve with a pipe wrench or other readily available tool. The stem material shall provide a minimum 70,000psi tensile strength with 15% elongation and yield strength of 30,000psi. Valves with cast stems or two piece stem collars are not acceptable.
8. The NRS valves shall have a stuffing box that is o-ring sealed. Two o-rings shall be placed above and one o-ring below the stem thrust collar. The thrust collar shall be factory lubricated. The thrust collar and its lubrication shall be isolated by the o-rings from the waterway and from outside contamination providing permanent lubrication for long term ease of operation. Valves without a stuffing box are unacceptable. Valves without at least three stem o-rings are also unacceptable.
9. The valve body, bonnet, stuffing box, and disc shall be composed of ASTM A-126 Class B grey iron or ASTM A395 or A536 ductile iron. The body and bonnet shall also adhere to the minimum wall thickness as set forth in Table 2, section 4.3.1 of AWWA C509. Wall thickness less than that in table 2 are not acceptable.
10. The valve disc and guide lugs must be fully (100%) encapsulated in SBR ASTM D2000 rubber material. The peel strength shall not be less than 75 pounds per inch. Guide caps of an acetal bearing material shall be placed over solid guide lugs to prevent abrasion and to reduce the operating torque.
11. The valves shall have all internal and external ferrous surfaces coated with a fusion bonded thermosetting powder epoxy coating of 10 mils nominal thickness. The coating shall conform to AWWA C550.

12. The tapping valves shall have an inlet flange conforming to ANSI B16.1 Class 125 for attachment to a tapping sleeve or cross. In addition, the valve inlet flange shall have a machined projection or raised face complying with MSS SP-60 for accurate alignment to the mating recess in the tapping sleeve flange. The seat opening of the tapping valves shall be at least .30" larger than the nominal pipe size to permit full diameter cuts.

13. The valves shall be warranted by the manufacturer against defects in materials or workmanship for a period of ten (10) years from the date of manufacture.

Valve Boxes: Valve boxes shall be cast iron. Boxes shall be provided over all operating nuts of valves 16" and smaller. The word "WATER" shall be cast in the top cover. All parts of the valve box shall be bituminous coated. Valve extension pipe shall be eight inch (8") SDR 35 PVC pipe, 8" Ductile iron pipe, or smooth exterior wall non-reinforced concrete drain pipe. Boxes shall be H20 load approved.

Valve boxes shall be installed plumb and flush with surrounding grade. Boxes shall be installed so as to insure no harm is done to the valve. Boxes shall be Tyler Union, Bass & Hays or approved equal.

Valve Joints and Bolts: All valves shall be either mechanical joint or flanged, as detailed on the plans except for tapping valves which shall have a mechanical connection one side and a flange on the other side. All flanged valve bolts shall be either galvanized or stainless steel. Mechanical Joint valves shall have standard ductile iron "T" bolts, and shall be furnished with the restrained mechanical joint rings. All flanged joints shall be made using full face synthetic rubber gaskets. Natural red rubber gaskets and gaskets containing asbestos materials will not be allowed for either flanged or mechanical joint connections.

PART 3 – EXECUTION

Valves shall be installed as outlined by written manufacturer's specifications.

TRANSITION COUPLING

PART 1 – GENERAL

Connections between pipes of differing outside diameters shall be accomplished using a transition coupling. Transition couplings provide no axial restraint and therefore shall require concrete blocking. Transition couplings shall be Smith-Blair.

PART 2 – PRODUCTS

Transition coupling materials shall conform to the following:

Sleeve: ASTM A-53, ASTM A-513 or carbon steel having a minimum yield of 30,000 psi.

Followers: Ductile Iron ASTM A536.

Gaskets: Nitrile or Buna-N-NSF61-Compounded to produce superior storage and performance characteristics while resisting water, acids, alkalies, most (aliphatic) hydrocarbons and many other chemicals. Temperature range -20°F. to 180°F.

Nuts and Bolts: High-Strength, low alloy steel with heavy, semi-finished hexagon nuts.

Finish: Fusion bonded Flexi-Coat epoxy.

PART 3 – EXECUTION

Transition couplings shall be installed according to written manufacturer's recommendations.

PIPE RESTRAINT SYSTEM

PART 1 – GENERAL

This specification shall govern the design, manufacture, fabrication and installation of Restraint systems for Ductile Iron and PVC Pipe for water supply and transmission. All material shall be new. The system shall be Ford Uni-Flange Series 1300, 1350, 1360, 1390 or EBAA Series 2000SV, 2800, 1600 or as approved by District.

PART 2 – PRODUCTS

Material Requirements: The system shall incorporate a series of machined serrations (not "as cast") on the inside diameter to provide positive restraint, exact fit 360 degrees contact and support of the pipe wall. Restraint device shall be manufactured of high strength Ductile Iron Material (ASTM A536) for smaller size pipe or high-grade steel for larger size pipe. Bolts and connecting hardware shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11. Bolts shall be hot-dipped galvanized or stainless steel. The devices shall meet or exceed the requirements of Uni-B-13-94.

Restraint Systems shall conform to the following:

C-900 PVC – Restraints may be integrated packing gland, restraint ring or restraint ring and mechanical joint packing gland

C-905 PVC – Restraint ring and mechanical joint packing gland

Ductile Iron - integrated packing gland and restraint ring

PART 3 – EXECUTION

The restraint devices shall be installed at mechanical joint fittings and at ductile iron and PVC pipe joints as noted. The devices shall be installed in accordance with manufacturer's recommendations. Each device shall be wrapped in two layers of polyethylene sheets. The minimum downstream and upstream requirements for placing joint restraints (at bell & spigot connections) shall be as recommended by the manufacturer for the proposed laying conditions. Minimum allowable lengths are detailed in the District standard details.

PVC PIPE

PART 1 – GENERAL

All materials shall be approved for use in potable water systems by the National Sanitation Foundation (NSF), Standard 61.

PART 2 – PRODUCTS

C900 WATERLINE PIPE: PVC piping 4" through 12" diameters shall meet the requirements of the latest revision of AWWA Standard C900, 'Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4" through 12" for Water' and shall be furnished in cast-iron pipe equivalent outside diameters. All pipe shall be suitable for use as a pressure conduit for potable water. The pipe shall meet the requirements of Uni-Bell Standard Uni-B-3 and shall be approved by Underwriter's Laboratories for use as a fire main.

Pressure Class: The pipe shall be Class 150 with a DR of 18.

Couplings: The pipe shall be joined using integral bells and spigot couplings. The bell shall consist of an integral wall section with a synthetic rubber, locked in place, gasket. The gasket shall comply with the requirements of the latest revision of ASTM F-477, "Elastomeric Seals (Gaskets) for Joining Plastic Pipe". Natural rubber rings will not be acceptable.

C905 WATERLINE PIPE: PVC piping greater than 12" diameter shall meet the requirements of AWWA C-905, latest revisions for "Polyvinyl Chloride (PVC) Water transmission Pipe, Nominal Diameter 14 in through 48 in".

Pressure Class: The pipe shall be Class 235 with a DR of 18.

Couplings: 14" and larger pipe shall be joined using integral bell and spigot couplings. The bell shall consist of an integral wall section with a synthetic rubber gasket ring that meets the requirements of the latest revision of ASTM F-477, "Elastomeric Seals (Gaskets) for joining Plastic Pipe". The bell section shall be designed to be at least as strong as the pipe wall. Natural rubber rings will not be acceptable.

PVC PIPE >6" IN DIAMETER:: Pipe sizes less than six inches in diameter shall meet the requirements of ASTM D2241 and shall be furnished in steel pipe equivalent outside diameters. Pipe and fittings 1" and smaller shall be schedule 80 PVC. The pipe shall bell and spigot, solvent cement joints, meeting the requirements of ASTM D1785 and ASTM D2672 or the pipe shall be screwed joints and fittings as required.

PRESSURE TESTING: Each standard and random length of pipe shall be tested to four (4) times the pressure class of the pipe for a minimum of five (5) seconds. The integral bell shall be tested with the pipe.

RANDOM TESTS: The District may subject random lengths of pipe to testing by an independent laboratory for compliance with this specification. Any visible defect or failure to meet the quality standards herein will be grounds for rejecting the entire order.

DELIVERY: Pipe shall be bundled in pallets for ease of handling and storage. Pipe bundles shall be packaged to provide structural support to insure that the weight of upper units shall not cause deformation to pipe in lower units. No pipes bundles shall be accepted which show evidence of ultraviolet radiation "sunburn" on exposed pipe as may be caused from extended unprotected storage conditions. Pipe shall be homogenous throughout. It shall be free from voids, cracks, inclusions, and other defects. It shall be as uniform as commercially practical in color, density, and other physical properties. Pipe surfaces shall be free from nicks and scratches. Joining surfaces of spigots and joints shall be free from gouges and imperfections that could cause leakage.

Pipe shall be inspected by the District to assure that it meets specifications. When a load of pipe is found to have inadequate wall thickness or tolerances greater than specified, randomly selected samples of the pipe shall be immediately forwarded to an approved testing laboratory with instructions to check the pipe for compliance with applicable product standards, ASTM specifications and other specifications for the specific contract. When the testing laboratory reports concur that the pipe does not meet specifications, it is to be understood that all of the defective pipe delivered to the site will be immediately removed and replaced by the contractor at no additional cost to the owner.

FITTINGS: Fittings shall be ductile iron in accordance with AWWA C110, AWWA C153, or AWWA C606, latest revisions.

Cement Lining: Fittings shall be internally lined with cement mortar in accordance with AWWA C104. The lining thicknesses shall be equal to or greater than those for comparable size pipe.

Buried Service Fittings: Fittings, sizes 4" – 24", with push-on, restrained push-on, or mechanical joints shall be rated for 350 psi working pressure. Fittings, sizes 30" – 64", with push-on, restrained push-on, or mechanical joints shall be rated for 250 psi working pressure.

Small pipe Fittings: 3" and 2" mechanical joint fittings shall be supplied with a transition gasket, allowing them to accept iron pipe equivalent outside diameter. 4" and larger diameter pipe shall be supplied with transition gaskets, if necessary, to allow them to accept the ductile iron fittings.

PART 3 – EXECUTION

INSTALLATION: PVC pipe shall be installed in accordance with District Standards and with the Uni-Bell Plastic Pipe Association guide for installation of PVC pressure pipe for municipal water distribution systems.

DUCTILE IRON PIPE AND FITTINGS

PART 1 – GENERAL

SCOPE: This specification shall govern the design, manufacture, fabrication and installation of Ductile Iron Pipe and fittings for water supply and transmission. All pipe and fittings must be new. The pipe, fittings, coatings, lubricants, gaskets, etc., must be NSF, Standard 61 approved.

STANDARDS: The following standards govern ductile iron pipe and fittings. Where standards, specifications or methods are cited without dates, the reference shall be construed to apply to the latest revision in effect at the time of contract.

- AWWA C104:Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
- AWWA C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
- AWWA C110: Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in for Water and Other Liquids
- AWWA C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- AWWA C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
- AWWA C150: Thickness Design of Ductile-Iron Pipe
- AWWA C151: Ductile-Iron Pipe, Centrifugally Cast for Water
- AWWA C153: Ductile-Iron Compact Fittings, 3-in through 24-in and 54-in through 64-in for Water Service
- AWWA C600: Installation of Ductile-Iron Water Mains and their Appurtenances

PART 2 - PRODUCTS

PIPE DESIGN: All ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and AWWA C151, respectively, for the following minimum operating conditions:

- The minimum internal design pressure shall be 150 psi with a 100-psi surge allowance, with a safety factor of 2, for a total internal design pressure of 500 psi. No reduction of safety factor for transient pressures shall be allowed.
- The external loads design criteria shall be a minimum of 4' depth of cover at 120 lbs. per cubic feet soil weight and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.
- The horizontal deflection of cement-mortar lined ductile iron pipe resulting from external load conditions shall not exceed 3% of the pipe diameter.
- The pipe trench, per AWWA C150, for design purposes shall be: Type 4 – Pipe bedded in sand, gravel or crushed stone to depth of 1/8 pipe diameter, 4" minimum. Backfill compacted to top of pipe.

MINIMUM PIPE CLASS: Ductile iron pipe shall conform to AWWA C151. All pipe shall have a minimum pressure rating as indicated below, or higher ratings as indicated in the contract documents:

- DI pipe 4”-12” dia. 350 PSI
- DI pipe 14”-20” dia. 250 PSI
- DI pipe 24” dia. 200 PSI
- DI pipe 30” – 64” dia. 150 PSI

JOINTS, GASKETS, BOLTS AND NUTS:

- Joints: Ductile Iron Pipe and fittings shall be furnished with push-on joints, push-on restrained joints, mechanical joints, flanged joints, and grooved joints as required.
- Push-on Joints: Push-on joints shall conform to AWWA C111.
- Mechanical Joints: Mechanical joints shall conform to AWWA C111.
- Gaskets: Gaskets shall be Viton or EPDM, natural rubber and Buna N are not allowed.
- Bolts and Nuts: Bolts shall be high-strength, low-alloy steel per AWWA C111.

FITTINGS: Fittings shall be ductile iron in accordance with AWWA C110, AWWA C153, or AWWA C606, latest revisions.

- Cement Lining: Fittings shall be internally lined with cement mortar in accordance with AWWA C104. The lining thicknesses shall be equal to or greater than those for comparable size pipe.
- Buried Service Fittings: Fittings, sizes 4" – 24", with push-on, restrained push-on, or mechanical joints shall be rated for 350 psi working pressure. Fittings, sizes 30" – 64", with push-on, restrained push-on, or mechanical joints shall be rated for 250 psi working pressure.

LINING: Ductile iron pipe, specials, and fittings shall be lined with cement-mortar lining with an asphaltic seal coating, 1 mil, in accordance with AWWA C104.

EXTERIOR COATING FOR BURIED DI PIPE: The exterior of ductile iron pipe, special, and fittings shall be coated with a 1-mil asphaltic coating in accordance with AWWA C151. When specified, loose polyethylene encasement shall be supplied in accordance with AWWA C105.

PART 3 – EXECUTION

INSTALLATION: The pipe shall be laid to the lines and grades specified by the Engineer. After the pipe has been laid, sand bedding material shall be brought up uniformly on each side of the pipe to the center of the pipe and mechanically tamped to a minimum of 85% proctor. The sand bedding material shall be placed to a point four (4”) inches above the top of the pipe including bell and mechanically tamped to a minimum of 85% proctor. Care shall be exercised to see that the bedding material is well tamped under the pipe before bringing backfill up on the sides of the pipe. No voids or loose material around the pipe will be permitted. This bedding material backfill shall be mechanically tamped.

After this mechanically tamped bedding material has been placed, the remainder of the trench shall be backfilled and this portion of the backfill material shall be either water consolidated or mechanically tamped to a minimum of 85% proctor. The material used shall be free from rocks, roots, boulders or other unsatisfactory materials, including materials that would damage the polyethylene wrapping.

POLYETHYLENE WRAPPING

PART 1 – GENERAL

SCOPE: All ductile or cast iron or steel pipe, pipe restraints or other metal water system appurtenances laid below ground shall be wrapped in black polyethylene sheet as outlined below. Soil which is onto the pipe, valve, or metal shall be removed before installing the polyethylene.

PART 2 – PRODUCTS

MATERIAL: Polyethylene sheets shall have a minimum thickness of 8 mils.

PART 3 – EXECUTION

PLACEMENT ON PIPE: All ductile or cast iron pipe or steel pipe laid below ground shall be encased in two (2) layers of black polyethylene sheet placed on each joint as it is being laid, in accordance with AWWA Standard C-105, Method C, latest revision. The sheets shall be of sufficient size to provide a 12" lap at all longitudinal and transverse joints. Sheets shall be of virgin black polyethylene. The sheets shall be taped together at intervals along the joints, leaving at least 90% of the joint open.

Care shall be taken to avoid tearing or puncturing the sheet during installation and during placing and compaction of backfill. Tears and punctures shall be repaired with eight (8) mil black polyethylene sheet and/or tape.

PLACEMENT ON FITTINGS AND VALVES: Fittings and valves which are to be buried shall be loose wrapped with two layers of eight (8) mil black polyethylene sleeves or sheet. The sheet or sleeve shall be taped to the valve or fitting wherever operating parts must project. Tears and punctures shall be repaired as outlined above.

SERVICE CONNECTIONS

PART 1 – GENERAL

All new water service pipe, fittings, connectors, nipples, washers, and other appurtenances shall be non-corrosive metal (copper, brass, bronze, etc) except as otherwise specified and shall be as intended for use with other specified materials. The use of galvanized iron, steel, or plastic fittings with copper and other higher grade specified materials shall not be permitted or accepted.

PART 2 – PRODUCTS

CORPORATION STOPS: Corporation Stops shall be brass, complete with a pack joint fitting with a retainer screw and AWWA Standard threads as per AWWA C800. Taps shall be located at 10:00 or 2:00 o'clock on the circumference of the pipe. Service taps shall be staggered alternating from one side of the water main to the other and at least 12 inches apart. The taps must be a minimum of 24 inches apart if they are on the same side of the pipe. Acceptable manufacturers shall be Mueller, or Ford Meter Box Company. No burned taps will be allowed and each corporation stop will be wrapped with Teflon tape for ductile iron pipe water mains.

CURB STOPS: Curb Stops shall be designed to receive the service pipe connection with straight coupling nut on the street side and on iron pipe thread connection on the opposite side. Curb stops shall be manufactured by Mueller, or Ford Meter Box Company.

SERVICE SADDLES: Service saddles shall double band stainless steel repair saddles, double band brass saddles or double strap brass saddles. Saddles shall be Mueller, or Ford Meter Box Company.

SERVICE TUBING: Copper Service Tubing shall be type K soft copper tubing per ASTM B88. The longest available length of service line should be used with no unions. As an example for a 3/4 inch service connection, no union shall be used in the installation of 60 feet or less. For 3/4 inch, only one (1) union will be allowed for each one hundred (100) foot section or fraction thereof. Unions shall be made with pack joint fitting with a retaining screw.

METER BOXES: Meter Boxes for 5/8 inch services shall be of round style and made of Polyvinyl Chloride Plastic with a minimum wall thickness of .375 inches. The box shall be sized to accept a 5/8, 3/4, and 1-inch water meter and shall have a minimum inside diameter of 18-inches with a 30-inch depth. The box shall have a non-locking cast iron lid.

PART 3 – EXECUTION

All service connection appurtenances shall be installed per written manufacturer's instructions. See District Standard Detail.

HYDROTESTING

PART 1 – GENERAL

SCOPE: This item covers the requirements for the hydrostatic test of the water lines.

PART 2 – PRODUCTS

PART 3 – EXECUTION

TEST PROCEDURE: Pipe sections shall be hydrostatic tested as follows:

The Contractor shall install new pipelines to approximately 20 feet within the new connections or proposed changes in pressure classes. A temporary cap or plug shall be installed on each pipe end and temporarily blocked for pressure testing. After the pipe has been laid, the line pressure shall be held at fifty (50) psi for a period of twenty-four (24) hours. The Engineer shall be notified before filling any section of the pipe. A pressure gage with a minimum diameter of 4" and 5 pound numbered marking and individual markings at each 1 pound shall be furnished by the Contractor. The Contractor shall also furnish a pressure pump with drive and a meter which will measure 0.10 gallon to perform the hydrostatic test.

Before applying the specified test pressure, all air shall be expelled from the pipe. If additional taps are necessary to expel this air, they shall be made at appropriate points and tightly plugged after the test is completed. All exposed pipes, fittings, valves, and joints will be examined carefully during the test. All joints showing visible leaks, drips, seeps, etc. shall be made tight, or shall be cut out and replaced, at the Contractor's expense, as directed by the Engineer. Any cracked or defective pipe joints, fittings, or valves discovered in consequence of this pressure test, shall be removed and replaced by the Contractor with sound material, and the test shall be repeated until satisfactory to the Engineer. When hydrants are in the test section, the test shall be run against the closed hydrant and not the valve on the lead. Pipes shall be tested with all service connections from main pipe to meter location installed.

After the 24-hour stabilization, the pipeline shall be held at the test pressure of one hundred fifty (150) psi for a minimum of two (2) hours during which time the leakage determination shall be made.

WATER FOR TESTING: The District will provide water for one testing, disinfection, flushing and filing. Any additional water required will be purchased by the contractor from the owner at standard water rates.

LEAKAGE: Acceptable leakage for ductile iron pipe, concrete steel cylinder pipe and PVC pipe shall be less than the value indicated by the following formula:

$$L = \frac{NxDx(P)^{(1/2)}}{7400}$$

where: L = max. allowable leakage, in gallons/hour
N = number of joints in tested length
D = nominal diameter of pipeline, in inches
P = mean test pressure, in pounds/sq. inch

Should any test of combined sections of pipe laid disclose leakage greater than the specified limit, the Contractor shall at his own expense, locate and repair the defective joints until the leakage is within the specified allowance. Repairs and test shall be repeated until the line shows no defects and is accepted by the Engineer.

GUARANTEE: The pipe Contractor shall guarantee the pipeline against leaks and breaks due to defective materials or workmanship, for a period of one (1) year from the date of completion of the contract. Damage or leaks due to the acts of God or from sabotage and/or vandalism occurring after the pipeline has been accepted and placed in operation are specifically not a part of this guarantee.

When defective material and workmanship are discovered requiring repairs to be made under this guarantee, all such repair work shall be done by the Contractor at his own expense within five (5) days after written notice of any leaks has been given him by the Owner. Should the Contractor fail to repair such leaks within five (5) days thereafter, the Owner may make the necessary repairs and charge the Contractor with the actual cost of all labor and material required. In emergencies demanding immediate attention, the Owner shall have the right to repair the same and charge the Contractor with the actual cost of all labor and materials required.

DISINFECTION

PART 1 – GENERAL

After satisfactory completion of the pressure test, disinfect new potable water mains and existing mains that have required repair in accordance with AWWA C651 and as specified herein. Disinfect water mains in a maximum length per day of 2,000 feet. The Contractor shall provide a superintendent experienced in the required procedures for disinfecting with chlorine.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

Connection to Existing System: Notify the District 48 hours prior to making connections to the existing system. Thoroughly clean the existing water main exterior prior to the installation of tapping sleeves and corporation stops. Lightly dust with calcium hypochlorite powder the water main exterior and the interior surface of the tapping sleeve, and corporation stops. After satisfactory flushing of the main, disinfect by the injection of a chlorine solution. Induce chlorine in sufficient quantity to maintain a chlorine residual of at least 50 ppm throughout the system to be tested. Maintain the chlorine solution in the system for at least 24 hours. Prior to flushing, the free chlorine residual shall be a minimum of 25 ppm. Flushing of the lines shall proceed until the lines contain the normal chlorine residual of the system.

Valves and Fire Hydrants: Open and close valves on the mains being disinfected a minimum of three (3) times during the chlorine contact period and a minimum of three (3) times during flushing. Fire hydrants and other appurtenances should receive special attention to insure proper disinfection.

Cut-In Construction: Use the following procedures for disinfecting of the new installation and the existing main at the cut-in point in accordance with AWWA C651, Section 9:

- Apply liberal quantities of hypochlorite, in the form of tablets, to the open trench.
- Interior of new pipe and fittings and the ends of the existing mains shall be swabbed or sprayed with a 1 percent hypochlorite solution before installation.
- Install a 2-inch tap downstream of the work area. The tap shall be used for blowing off the main. Or, use the next fire hydrant downstream of the work area for blowing off the main.
- Install a 2-inch tap just upstream of the new installation. Control water from the existing system so as to flow slowly into the work area during the application of chlorine. After the line is thoroughly flushed, add chlorine solution at a concentration of 100 ppm by the continuous feed method and hold in the main for 1 hour.

Bacteriological and Chlorine Residual Sampling and Testing:

- Test for free chlorine residual at required bacteriological test locations immediately after induction of highly chlorinated water and again after 24 hours, prior to flushing of the highly chlorinated water from the potable water system.
- Obtain two samples at each location specified after the chlorination procedure is completed, and prior to placing the system in service. Take the first sample immediately after flushing of the chlorinated water and again in 24 and 48 hours. A set of samples shall be taken as a minimum at the following locations:
    - Every 1,200 lf.
    - End of each main.
    - A minimum of one from each branch.
    - Mains at cut-in locations: Each side of work area. Time between samples to be determined by District Inspector in the field.
- Recommended additional samples. During the required sampling of water from the new system, it is recommended that samples be taken from the existing potable water source to determine if coliforms are present.
- Care in sampling. No hose or fire hydrant shall be used for the collection of samples. Take samples from an approved sample tap consisting of a corporation stop installed in the main with a copper tube gooseneck assembly. Operation shall be such as to ensure that the sample collected is actually from water that has been in the new system.
- Test samples for the presence of coliform organisms in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater. Testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique.
- Testing shall be performed by a laboratory certified for the required testing by the State of Texas.
- Test for odor. The water in the new system should also be tested to assure that no offensive odor exists due to chlorine reactions or excess chlorine residual.
- If samples show the presence of coliform, one of the procedures described below shall be followed, with the approval of the District, before placing the unit or facility in service:
    - Take repeat samples at least 24 hours apart until consecutive samples do not show the presence of coliform.
    - Again subject the system to chlorination and sampling as described in this section.
- If samples are free of coliform, and with the approval of the District, the potable water system may be placed in service.

Contamination: If, in the opinion of the District, possible contaminants have entered the existing water system, or water samples show the water in the existing system to be unsafe on completion of the work, the entire disinfection process shall be repeated at no additional cost to the District.

PRESSURE PIPE INSTALLATION

PART 1 – GENERAL

SCOPE: This specification covers the requirements for labor, equipment, and material necessary to install pressure water line for use in water supply and distribution systems.

INSPECTION:

- Inspection of Material at Delivery Point: When received from the carrier and at the time of unloading, the Contractor and Inspector shall inspect all pipe and accessories for loss or damage in transit. No shipment of material should be accepted by the Contractor unless proper exceptions are made on the receipt obtained by the carrier, at the time of delivery, as to loss and/or damage.
- Field Inspection of Material and Workmanship: All laying, jointing, testing for defects and for leakage under pressure, and disinfection, shall be performed in the presence of the Owner's Engineer or his authorized inspector, and shall be subject to his approval before acceptance.
- Disposition of Defective Material: All material found during the progress of the work to have cracks, flaws, or other defects will be rejected by the Owner's Engineer or his authorized inspector and the Contractor shall promptly remove such defective material from the site of the work.

CONTRACTOR'S RESPONSIBILITY FOR MATERIAL:

- Responsibility for Material Furnished by Contractor: The Contractor shall be responsible for all material furnished by him. All such material which is defective in manufacture or has been damaged in transit or has been damaged after delivery shall be replaced by the Contractor at his expense.
- Responsibility for Safe Storage: The Contractor shall be responsible for the safe storage of all material furnished to or by him and accepted by him until it has been incorporated in the completed project.

HANDLING OF PIPE AND ACCESSORIES:

- Handling and Care: Pipe and accessories shall, unless contrary instructions are received, be unloaded at the point of delivery, hauled to, and distributed at the site of the project by the Contractor. They shall at all times be handled with care to avoid damage. Material shall not be dropped or bumped against pipe or accessories already on the ground or against any other object on the ground. The pipe manufacturer will assist the Contractor in implementing proper handling procedures. The Contractor shall be responsible for any damage resulting from improper handling or care.
- Distribution at Site of Work: In distributing material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
- Materials Kept Clean: The interior of all pipe and accessories shall be kept free from dirt and foreign matter at all times.
- Standing Water: Pipe shall never be installed in a trench where there is standing water.

PART 2 – PRODUCTS

PART 3 – EXECUTION

ALIGNMENT AND GRADE:

- General: All pipe shall be laid and maintained to the required lines and grades. Fittings and valves shall be at the required locations and with joints centered, spigots home and all valve stems plumb.

- Protecting Underground and Surface Structures: Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense.
- Obstructions Caused by Other Utility Structures: Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or main drains, the obstruction shall be permanently supported, relocated, removed or reconstructed by the Contractor in cooperation with the Owner of such utility structures.
- Deviation With Engineers Consent: Deviation from the required line or grade as shown on the plans shall be made only with prior approval of the Engineer.
- Subsurface Explorations: Whenever necessary to determine the locations of existing underground utility structures, the Contractor, after an examination of available records and upon the written order of the Engineer, shall make all explorations and excavations for such purpose.

THRUST BLOCKING: Pipe ends, changes in direction, valves and all other fittings shall be thoroughly blocked by means of poured concrete, which shall extend the full width of the trench and from the bottom of the trench to a minimum of three (3) times the diameter of the pipe. Blocking shall bear against the fitting and shall be poured against undisturbed or tightly compacted earth. If the Contractor has cut the ditch beyond the end of the pipe, he shall extend the block one-half (1/2) width of the trench into each side wall of the trench and thoroughly compact the earth behind the block. Minimum thickness of the blocking shall be eight (8) inches, and reinforcing may be required by the Engineer if the block is not poured against undisturbed earth. Concrete shall be Class N-25, with a minimum compressive strength of 2500 psi at 28 days. The area bearing against undisturbed earth shall be as shown on the plans.

LOWERING PIPE AND ACCESSORIES INTO TRENCH:

- General: Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipe, fittings, valves, and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
- Inspection of Pipe and Accessories: The pipe and accessories shall be inspected, by both the Contractor and Inspector, for defects prior to lowering into trench. Any defective, damaged, or unsound pipe shall be repaired or replaced.
- Pipe Kept Clean: All foreign matter or dirt shall be removed from the interior of pipe before lowering into position in the trench. Pipe shall be kept clean by means approved by the Engineer during and after laying. Pipe ends shall be tightly plugged overnight, and provisions made to avoid flotation of pipe until final backfill is placed.
- Disinfection: When taking bacteriological tests is impossible, the Contractor shall wipe any item that will contact the water with a chlorine solution. The chlorine solution will contain a minimum of 50 mg/L chlorine. In addition, the Contractor shall place 5 pounds of HTH, 65% chlorine, in the pipe ahead of a connection, valve, or any place where the waterline has been open.

UTILITY LINE MARKING TAPE: Detectable underground marking tape, meeting OSHA regulation 1926.956 (c)(1), shall be installed over ALL utility lines. The detectable marking zone tape shall bear the printed identification of the Utility Line below it, such as "CAUTION - BURIED WATER LINE BELOW". Tape shall be permanently printed. Surface Printing will not be acceptable. The tape shall be constructed of material that will provide maximum color contrast and visibility in all types and colors of soil. The tape shall meet APWA

color code. The tape shall be lineguard III underground detectable tape or approved equal. The detectable marking tape shall be buried 6 inches over the top of the waterline. After placing sand embedment, the tape shall be placed in the backfill and allowed to settle in place with the backfill. Tape may be installed by any other method approved by the Engineer.

WATERLINE MARKERS: Waterline markers shall be provided on both sides of each county road, state highway, railroad track, and drainage ditch crossing for main waterlines.

- MARKERS: The markers shall consist of a pressure penta-treated post - minimum diameter of 4" - and a fiberglass sign. The post shall be 8' long and shall be buried a minimum of 3'. The top of the post shall be notched to allow the sign to be placed against a flat surface. The sign shall be constructed of a composition of fiber reinforced fiberglass, marble, and thermosetting polymers. The signs shall be 6" high, 12" long, and 0.135 inches thick. The sign shall be resistant to U.V. degradation. The sign shall be manufactured by Carsonite or approved equal.
- LETTERING: The sign shall be white with black letters. The letters shall be as follows:
    - CAUTION WATERLINE (Larger Letters)
    - NCWCID #3 (Larger Letters)
    - CALL 387-4549 BEFORE (Smaller Letters)
    - DIGGING IN THIS AREA (Smaller Letters)
- ATTACHMENT: The signs shall be attached to the posts using 2 stainless steel wood screws, No. 14 by 1-1/2".

RIGHT OF WAY CROSSINGS

PART 1 – GENERAL

The following specification shall govern waterline crossings of rights of way.

PART 2 – PRODUCTS

Casing Pipe: Casing pipe, shall comply with the requirements of ANSI B36.10, latest revision, Standard for Welded and Seamless Pipe. Used pipe, in good condition (without pits) will be accepted, but must be inspected and approved by the District's Inspector. The minimum wall thickness shall meet requirements of governing agency, ie TxDOT, Nueces County, City of Robstown, UPRR, etc.

Casing Spacers: All casing spacer hardware including screws, bolts, nuts, etc. shall be stainless steel. Casing spacers shall be projection type totally non-metallic spacers constructed of performed sections of high-density polyethylene. Projection type spacers shall be RACI type spacers by Raci Spacers North America Inc. or approved equal.

PART 3 – EXECUTION

Casing Pipe: Pipe shall be installed per governing agency standards. All sections of the steel casing shall be completely welded together. No openings in the connection between sections of pipe will be permitted. Molded rubber end seals shall be sized to securely attach to the exterior of casing and carrier pipe to prevent water, dirt and debris from entering the annular space between the installed pipe. Install in accordance with the manufacturer's written instructions and as shown in the plans and details.

Casing Spacers: Casing spacers shall use double backed tape to fasten tightly onto the carrier pipe so that the spacers do not move during the installation. Written installation instructions shall be provided with each shipment. Casing spacers shall have a maximum span of 10 feet dependent on the total load anticipated with the pipe full of liquid. Spacers at each end shall not be further than 12-inches from the end of the casing regardless of the size of casing and carrier or type of spacer used. The maximum load shall not exceed the load limits per spacer listed by manufacturer. A minimum of three (3) casing spacers per pipe is required for each joint. Spacer runners shall have minimum height that clears the pipe bell or as otherwise indicated on plans.

BACKFILL SAND

PART 1 – GENERAL

Backfill sand shall be used in the installation of all pipe and underground appurtenances. All pipe, valves and fittings shall be completely encased with a minimum of eight inches (8") of sand. The contractor shall provide submittal information on proposed backfill sand.

PART 2 – PRODUCTS

SAND: The sand shall be finely divided sand having the following specifications:

Passing 7/8 Sieve:	100% by weight
Passing No. 4 Sieve:	80% by weight
Clay:	Less than 20% by weight
Plasticity Index:	NP-10 max.

The sand shall have low chloride content (salt) which shall not exceed 200 ppm chlorides when used in association with Concrete Steel Cylinder or Ductile Iron Pipe. Sand used for PVC pipe does not need to meet the chloride requirements. The sand shall contain no rocks, portions of any trees including stumps or roots, and no large clumps of clay which are more than two Inches (2") in diameter.

PART 3 – EXECUTION

The sand shall be placed and compacted to eliminate any voids around the pipe. The material shall be compacted to a minimum 85% standard proctor.